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by Daniel Thomas

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Subnetting**

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Table of Contents

Table of figures	3
Element 1	5
1. Introduction	5
2. Research	6
Data encapsulation <i>OSI Models</i>	8
Data Decapsulation	9
Data Broadcasting	10
Port Allocation	10
3. Design requirements	11
4. Implementation	13
5. Test and analysis	21
6. Evaluation	25
Element 2	26
1. Introduction	26
2. System Configuration Requirements	27
3. Implementation	32
CIDR/27 and CIDR/30 <i>CIDR /28</i>	34
4. Testing and Analysis	37
5. Evaluation	40
Element 3	41
1. Introduction	41
2. System configuration requirements	42
3. Implementation	44
4. Testing and analysis	51
5. Conclusions and recommendations	56
References	57
Appendix	58

Detailed table of contents. Two parts missing.

Table of figures

Figure 1 OSI 7-layer model.....	6
Figure 2 TCP/IP 4-layer model.....	7
Figure 3 Data Encapsulation model.....	9
Figure 4 Data Decapsulation model.....	9
Figure 5 Element 1 Network Setup	11
Figure 6 Class Addresses and router Addresses.....	12
Figure 7 Router 1 static routing code.....	13
Figure 8 Routing table router 1.....	14
Figure 9 Router 2 static routing code.....	14
Figure 10 Routing table router 2.....	15
Figure 11 Router 3 static routing code.....	15
Figure 12 Routing table router 3.....	16
Figure 13 Router 1 dynamic routing code.....	17
Figure 14 Dynamic routing table router 1.....	17
Figure 15 Router 2 dynamic routing code.....	18
Figure 16 Dynamic routing table router 2.....	18
Figure 17 Router 3 dynamic routing code.....	19
Figure 18 Dynamic routing table router 3.....	19
Figure 19 Router 1 dynamic addressing across networks using DHCP.....	20
Figure 20 Address exclusion configuration using router 1 as control device.....	20
Figure 21 Static routing test table.....	21
Figure 22 Dynamic routing test table.....	21
Figure 23 PC 0 DHCP without helper address.....	22
Figure 24 PC 1 DHCP without helper address.....	22
Figure 25 PC 2 DHCP without helper address.....	22
Figure 26 PC 1 DHCP helper address.....	23
Figure 27 PC 2 DHCP helper address.....	23
Figure 28 PC 0 test for excluded addresses.....	23
Figure 29 Figure 28 PC 1 test for excluded addresses.....	24
Figure 30 Figure 28 PC 2 test for excluded addresses.....	24
Figure 31 Network design using CIDR/28 subnetting.....	27
Figure 32 CIDR/28 Rome	28
Figure 33 CIDR/28 Paris.....	28
Figure 34 CIDR/28 London	28
Figure 35 CIDR/28 Paris-Rome.....	29
Figure 36 CIDR/28 Paris-London.....	29
Figure 37 CIDR/28 London-Rome	29
Figure 38 CIDR/27 Network table.....	30
Figure 39 CIDR/30 Network table.....	30
Figure 40 CIDR/27 VLAN London.....	31
Figure 41 Rome CIDR/27 and CIDR/30 CLI	34
Figure 42 Paris CIDR/27 and CIDR/30 CLI	34
Figure 43 London CIDR/27 and CIDR/30 CLI	35
Figure 44 London Routing Table CIDR/27 & CIDR/30	35
Figure 45 Rome Routing Table CIDR/27 & CIDR/30	36

Figure 46 Paris Routing Table CIDR/27 & CIDR/30	36
Figure 47 CIDR/28 Testing	37
Figure 48 CIDR/27 & CIDR/30 Testing	37
Figure 49 VLAN Testing	38
Figure 50 Ping Testing 1	38
Figure 51 Ping Testing 2	38
Figure 52 Diagram of real-life built system.	42
Figure 53 Physical setup of the system.	43
Figure 54 Activation of the webserver on the PLC.	44
Figure 55 File extension to the PLC.....	44
Figure 56 Input and output configuration.....	45
Figure 57 WWW block in the main block of the PLC.	45
Figure 58 html index and downloading it to the PLC.	46
Figure 59 setting up of IP addresses on PLC.....	47
Figure 60 VLAN Configuration Tests	51
Figure 61 VLAN Configuration Tests	52
Figure 62 VLAN Configuration Tests	53
Figure 63 DC motor control Web page running at 60%.	54
Figure 64 DC motor control Web page running at 60%.	55

Good extensive list of figures

Element 1

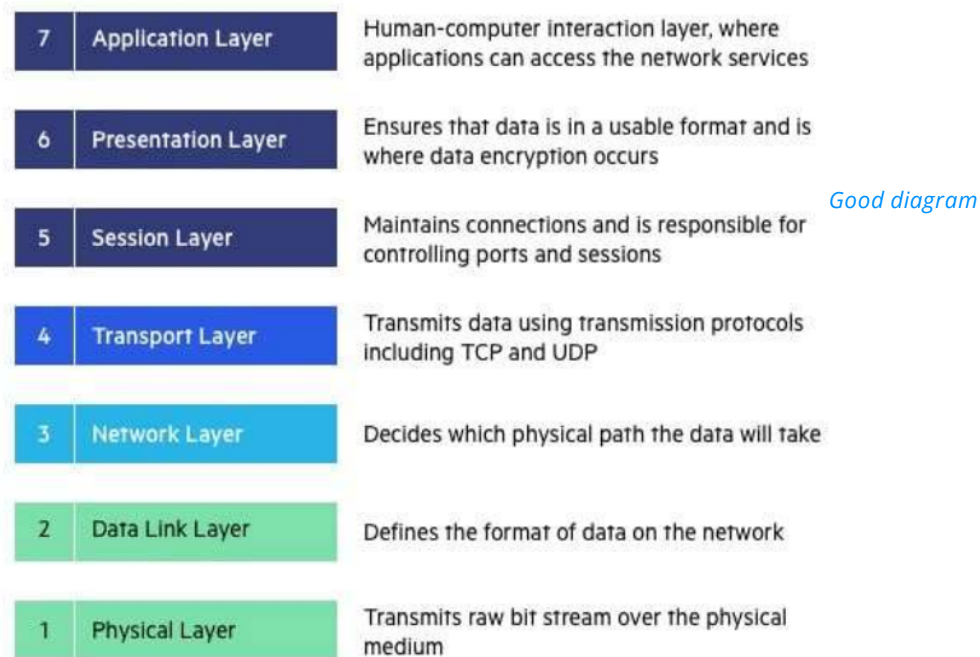
1. Introduction

In this Element research will be carried out on OSI 7 layer and 4-layer models with reference to network design, encapsulation, broadcasting, and port allocation. Also, a fully functioning network which has class A, B and C and addressing schemes for the LAN's and a separate scheme for two WANs. Static and dynamic addressing will be implemented and tested with sufficient evidence of configuration and test results. As well as this static and dynamic routing will be implemented and tested with sufficient evidence of configuration and test results finally an analysis will be carried out on the common protocols and the results will be explained.

Good intro that covers requirements

2. Research

OSI stands for open systems interconnection, and it has 7 layers which computer systems use to communicate over a network.



There should be a ref here

Figure 1 OSI 7-layer model.

Layer 1 is the physical layer and is responsible for the physical cable or the wireless connection between network nodes. These cables or connection transmit the raw data which is a simple string of zeros and ones.

Layer 2 is the data link layer it can establish or terminate a connection between two physically connected nodes on a network. It can break up the packets into frames and can send them from the source to the destination. This layer has two parts which are logical link control (LLC) and media access control (MAC)

Layer 3 is the network layer this layer has two main functions. One is to break up the segments in the network packets and reassembling them on the receiving end. The other function is routing the packets by choosing the best path to the physical network. This layer generally uses network addresses to route packets to the destination.

Layer 4 is the transport layer; this layer takes the transferred data from the session layer and breaks it down into segments on the transmitting end. It then reassembles the segments back into the receiving end. By turning it back into data which can then be used by the session layer. The transport layer carries out flow control and error control.

Layer 5 is the session layer which can create communication channels also known as sessions between devices. It is responsible for opening and closing sessions. And it can also set checkpoints during data transfer. If the session is interrupted at any point in time the device can resume data transfer from the last known checkpoint.

Layer 6 is the presentation layer which can prepare the data for the application layer. It tells two devices how to encode, encrypt and compress data so it can be received correctly on the receiving end.

Layer 7 is the application layer is used by web browsers and emails. It allows the software to send and receive information and present the data to users.

Layers are identified

Purpose should be included

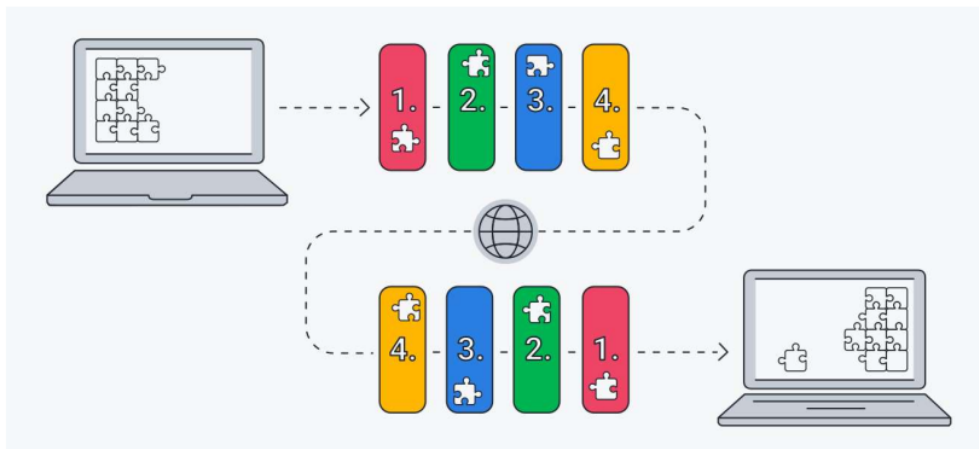


Figure 2 TCP/IP 4-layer model.

There should be a ref here

Citation should include date after author name

According to Danielle Bodnar "TCP/IP is a data link protocol used on the internet to let computers and other devices send and receive data." (2021) this stands for transmission control protocol/internet protocol. This protocol makes it possible for devices connected to the internet to communicate with each other across different networks.

Purpose is identified

Layer 1 is the network access layer which is also known as the data link layer which handles all the physical infrastructure that gives computers the ability to communicate with one another over the internet. Using ethernet cables, wireless networks etc.

Layer 2 is the internet layer which is also known as the network layer. It has the ability to control the flow and the routing of traffic, this ensures that all the data is sent fast and correctly. This layer can also reassemble the data packet at its destination.

Layer 3 is the transport layer which can provide reliable data connection between two devices trying to communicate. This layer divides all the data packets and gets acknowledgement that the packets arrived and that the receiving end received the packages.

Layer 4 is the application layer which is a group of applications that gives the user access to the network for example email and cloud storage programs.

4 layers are identified

Data encapsulation

Data encapsulation is a way to restrict the access to components of an object. This is done so users cannot access state values for all variables of an object. It can also be used to hide data members and functions.

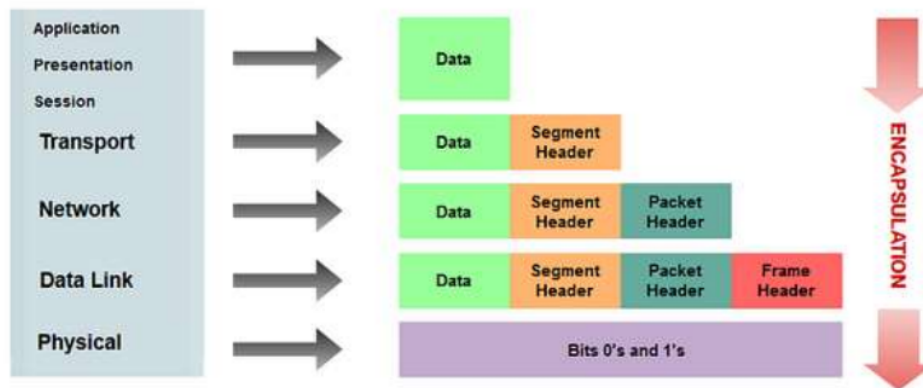


Figure 3 Data Encapsulation model.

[Ref needed here](#)

Data Decapsulation

Data decapsulation is also known as unwrapping and is a process in network protocols where a device such as a switch or a router removes the headers or trailers from a data packet to reveal the actual data. Decapsulation helps with the processing and routing packets to the correct network. It also helps different layers of the network to handle data packets with interpreting all the packets' data.



Figure 4 Data Decapsulation model.

[Ref needed here](#)

Explanations could be more detailed, however, the purpose is identified and with good supporting diagrams

Data Broadcasting

Incorrect citation

According to geeks for geeks "Broadcasting in computer networks is a type of communication mechanism that allows the message to be received by all the nodes of a network." (2021)

Broadcasting is used when information is to be sent to a large number of devices over the same network or Local area network. This can also be done on multiple networks which depends on the type of broadcast needed.

It is very easy to trouble shoot with broadcasting as it is easy to identify the corrupt resource and the potential security threats in a large network by sending a broadcast message.

Port Allocation

Correct citation

According to (Haber, N/A) "A port number is a way to identify a specific process to which an internet or other network message is to be forwarded when it arrives at a server." All devices connected to a network come with standardized ports that can have an unassigned number. These are reserved for specific protocols. (HTTP) for example always go to port 80. *Good point with common example*

Overall, there are 65,535 port numbers but not all of these ports are commonly used. Restricted port numbers are reserved and range from 0 to 1023. These are generally reserved by prominent companies. *Good point*

Some of the commonly used ports are 20 and 21 which are used to transfer files between client and customer. Port 25 is used as a mail transfer for emails. Port 123 is a network time protocol this helps the clocks on computers to all stay in sync with one another.

3. Design requirements.

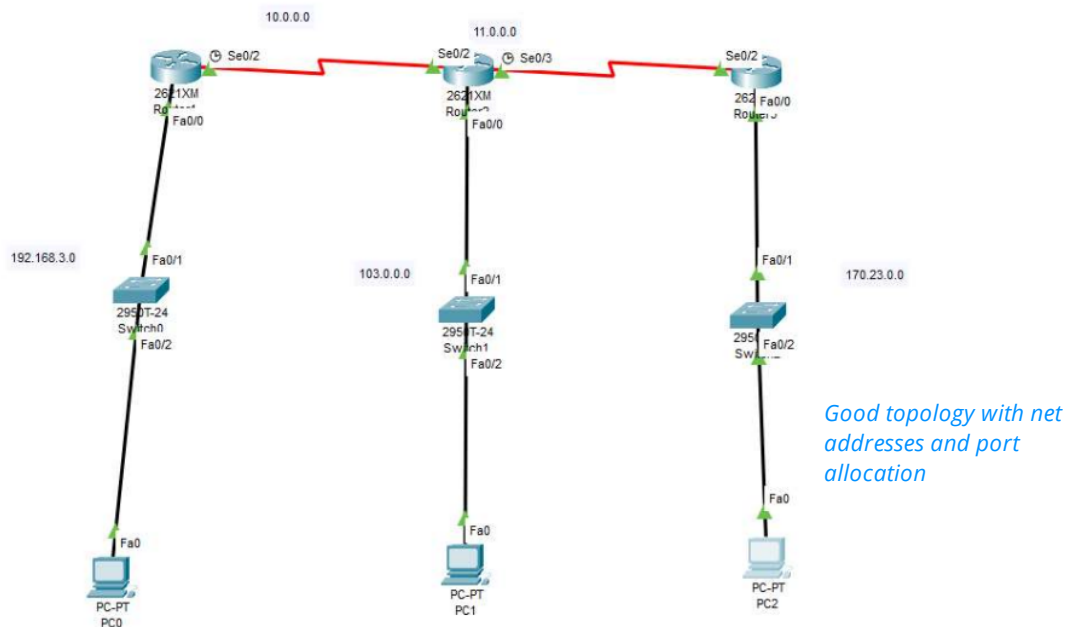


Figure 5 Element 1 Network Setup

The Design requirements of this element are to create a topology of a 3 LAN network and to create an addressing scheme for this topology. Various tests need to be carried out such as static addressing and routing protocols. Test using dynamic routing. Test using dynamic addressing protocol. Test dynamic addressing across all the routers. Also, a suitable address scheme needs to be configured which includes class A, B, C for the LAN networks. *Good points*

Class C	
192.168.3.0	Net address
192.168.3.254	Gateway address
192.168.3.1	Initial device address

The tables should be presented more effectively

Class B	
170.23.0.0	Net address
170.23.0.254	Gateway address
170.23.0.1	Initial device address

Class A	
103.0.0.0	Net address
103.0.0.254	Gateway address
103.0.0.1	Initial device address

Routers	
R0	
10.0.0.1	
R1	
10.0.0.2	
11.0.0.1	
R2	
11.0.0.2	

Net address scheme is identified for all networks including serial links

Figure 6 Class Addresses and router Addresses.

Figure 6 shows all the IP addresses used in the network setup for the classes and routers.

4. Implementation

Figure 5 shows the network setup which has 3 routers, 3 switch boards and three computers the routers are connected using serial links and each of the routers is connected to a PC with a switch board using Local Area Network (LAN)

[switch](#)

Each router had to have a suitable address by using static routing which had static addressing. The code below shows how each router was setup. The routing tables show the addresses when setup. [Good explanation](#)

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, Serial0/2
S    103.0.0.0/8 [1/0] via 10.0.0.2
S    170.23.0.0/16 [1/0] via 10.0.0.2
C    192.168.3.0/24 is directly connected, FastEthernet0/0
```

Figure 7 Router 1 static routing code.

Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial0/2	---	0/0
S	103.0.0.0/8	---	10.0.0.2	1/0
S	170.23.0.0/16	---	10.0.0.2	1/0
C	192.168.3.0/24	FastEthernet0/0	---	0/0

Table indicates all net addresses are routed

Figure 8 Routing table router 1.

```

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, Serial0/2
C    11.0.0.0/8 is directly connected, Serial0/3
C    103.0.0.0/8 is directly connected, FastEthernet0/0
S    170.23.0.0/16 [1/0] via 11.0.0.2
S    192.168.3.0/24 [1/0] via 10.0.0.1

```

Figure 9 Router 2 static routing code.

Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial0/2	---	0/0
C	11.0.0.0/8	Serial0/3	---	0/0
C	103.0.0.0/8	FastEthernet0/0	---	0/0
S	170.23.0.0/16	---	11.0.0.2	1/0
S	192.168.3.0/24	---	10.0.0.1	1/0

Correct routing table

Figure 10 Routing table router 2.

```

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

C    11.0.0.0/8 is directly connected, Serial0/2
S    103.0.0.0/8 [1/0] via 11.0.0.1
    170.23.0.0/24 is subnetted, 1 subnets
C      170.23.0.0 is directly connected, FastEthernet0/0
S    192.168.3.0/24 [1/0] via 11.0.0.1

```

Figure 11 Router 3 static routing code.

Type	Network	Port	Next Hop IP	Metric
C	11.0.0.0/8	Serial0/2	---	0/0
S	103.0.0.0/8	---	11.0.0.1	1/0
C	170.23.0.0/24	FastEthernet0/0	---	0/0
S	192.168.3.0/24	---	11.0.0.1	1/0

Correct routing table

Figure 12 Routing table router 3.

Figures 8-12 show the routing tables and static routing code for the static routing. These show that the IP addresses have been implemented.

After static routing was implemented. Dynamic routing could then be implemented using the same method as static routing but with different code and commands as seen below.

```

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#no ip route 103.0.0.0 255.0.0.0 10.0.0.2
Router(config)#no ip route 170.23.0.0 255.255.0.0 10.0.0.2
Router(config)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#^Z
Router#
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#net 192.168.3.0
Router(config-router)#net 10.0.0.0
Router(config-router)#net 103.0.0.0
Router(config-router)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#

```

Figure 13 Router 1 dynamic routing code.

Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial0/2	---	0/0
R	11.0.0.0/8	Serial0/2	10.0.0.2 120/1	
R	103.0.0.0/8	Serial0/2	10.0.0.2 120/1	
R	170.23.0.0/16	Serial0/2	10.0.0.2 120/2	
C	192.168.3.0/24	FastEthernet0/0	---	0/0

Correct dynamic routing table

Figure 14 Dynamic routing table router 1.

```

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#no ip route 170.23.0.0 255.255.0.0 11.0.0.2
Router(config)#no ip route 192.168.3.0 255.255.255.0 10.0.0.1
Router(config)#
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 103.0.0.0
Router(config-router)#net 10.0.0.0
Router(config-router)#net 11.0.0.0
Router(config-router)#net 170.23.0.0
Router(config-router)#net 192.168.3.0
Router(config-router)#^Z
Router#
%SYS-S-CONFIG_I: Configured from console by console

```

Figure 15 Router 2 dynamic routing code.

Type	Network	Port	Next Hop IP	Metric
C	10.0.0.0/8	Serial0/2	---	0/0
C	11.0.0.0/8	Serial0/3	---	0/0
C	103.0.0.0/8	FastEthernet0/0	---	0/0
R	170.23.0.0/16	Serial0/3	11.0.0.2	120/1
R	192.168.3.0/24	Serial0/2	10.0.0.1	120/1

Correct table

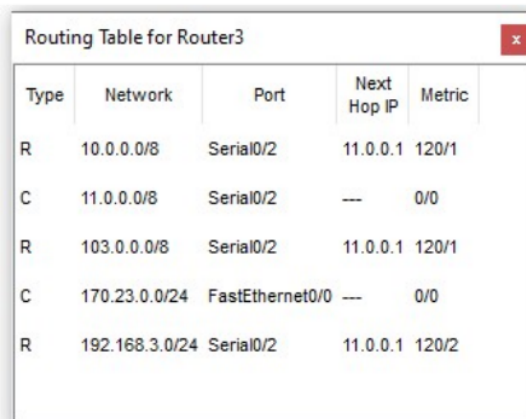
Figure 16 Dynamic routing table router 2.

```

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#no ip route 192.168.3.0 255.255.255.0 11.0.0.1
Router(config)#no ip route 103.0.0.0 255.0.0.0 11.0.0.1
Router(config)#
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 170.23.0.0
Router(config-router)#net 11.0.0.0
Router(config-router)#net 103.0.0.0
Router(config-router)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console

```

Figure 17 Router 3 dynamic routing code.



Type	Network	Port	Next Hop IP	Metric
R	10.0.0.0/8	Serial0/2	11.0.0.1	120/1
C	11.0.0.0/8	Serial0/2	---	0/0
R	103.0.0.0/8	Serial0/2	11.0.0.1	120/1
C	170.23.0.0/24	FastEthernet0/0	---	0/0
R	192.168.3.0/24	Serial0/2	11.0.0.1	120/2

Correct table

Dynamic routing evidence shows how the tables have been created for each router

Figure 18 Dynamic routing table router 3.

Figures 13-18 show the routing tables and dynamic routing code for the dynamic routing. These show that the IP addresses have been implemented.

There should be a heading here

```
Router>EN
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dhcp pool net1
Router(dhcp-config)#net 192.168.3.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.3.254
Router(dhcp-config)#dns-server 192.168.3.254
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp pool net2
Router(dhcp-config)#net 103.0.0.0 255.0.0.0
Router(dhcp-config)#default-router 103.0.0.254
Router(dhcp-config)#dns-server 103.0.0.254
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp pool net3
Router(dhcp-config)#net 170.23.0.0 255.255.0.0
Router(dhcp-config)#default-router 170.23.0.254
Router(dhcp-config)#dns-server 170.23.0.254
Router(dhcp-config)#exit
Router(config)#
Router(config)#
```

Good evidence of dynamic addressing implementation

Figure 19 Router 1 dynamic addressing across networks using DHCP.

Figure 19 shows Router 1 dynamic addressing across networks using DHCP. Router R1 is configured as the control router and routers R2 and R3 are configured without the helper address for dynamic addressing using DHCP.

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dhcp excluded-address 103.0.0.1 103.0.0.10
Router(config)#ip dhcp excluded-address 192.168.3.1 192.168.3.10
Router(config)#ip dhcp excluded-address 170.23.0.1 170.23.0.10
Router(config)#
Router(config)#
```

Exclusion addresses evidence

Figure 20 Address exclusion configuration using router 1 as control device.

5. Test and analysis.

PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC1	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC1	PC0	ICMP		0.000	N	1	(edit)	(delete)
	Failed	PC1	PC2	ICMP		0.000	N	2	(edit)	(delete)
	Successful	PC1	PC2	ICMP		0.000	N	3	(edit)	(delete)
	Successful	PC2	PC1	ICMP		0.000	N	4	(edit)	(delete)
	Successful	PC0	PC2	ICMP		0.000	N	5	(edit)	(delete)
	Successful	PC2	PC0	ICMP		0.000	N	6	(edit)	(delete)

Figure 21 Static routing test table.

Good set of test results

Figure 21 shows the static routing test table. This test demonstrates the communication in both directions for all the devices. This test uses the ping command in packet tracer where a packet is transmitted from one device to another. *Good explanation of test*

PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	PC0	PC1	ICMP		0.000	N	0	(edit)
	Successful	PC1	PC0	ICMP		0.000	N	1	(edit)
	Failed	PC1	PC2	ICMP		0.000	N	2	(edit)
	Successful	PC1	PC2	ICMP		0.000	N	3	(edit)
	Successful	PC2	PC1	ICMP		0.000	N	4	(edit)
	Successful	PC0	PC2	ICMP		0.000	N	5	(edit)
	Successful	PC2	PC0	ICMP		0.000	N	6	(edit)

Figure 22 Dynamic routing test table.

Figure 22 shows the dynamic routing test table. This test demonstrates the communication in both directions for all the devices. This test uses the ping command in packet tracer where a packet is transmitted from one device to another. *Good set of test results*

There should be a heading here for dynamic addressing test

☒ DHCP	☐ Static	DHCP request successful.
IPv4 Address	192.168.3.1	
Subnet Mask	255.255.255.0	
Default Gateway	192.168.3.254	
DNS Server	192.168.3.254	

Figure 23 PC 0 DHCP without helper address.

☒ DHCP	☐ Static	DHCP failed. APIPA is being used.
IPv4 Address	169.254.200.198	
Subnet Mask	255.255.0.0	
Default Gateway	0.0.0.0	
DNS Server	0.0.0.0	

Figure 24 PC 1 DHCP without helper address.

☒ DHCP	☐ Static	DHCP failed. APIPA is being used.
IPv4 Address	169.254.64.197	
Subnet Mask	255.255.0.0	
Default Gateway	0.0.0.0	
DNS Server	0.0.0.0	

Good test showing errors without helper addresses

Figure 25 PC 2 DHCP without helper address.

Figures 23-25 show the DHCP being tested without helper addresses. These addresses configurations are set dynamically.

Figures 24 and 25 show that the address configuration have not been set correctly and a default address has been automatically set. This is because the router needs the helper address to get across the network.

☒ DHCP	☐ Static	DHCP request successful.
IPv4 Address	103.0.0.1	
Subnet Mask	255.0.0.0	
Default Gateway	103.0.0.254	
DNS Server	103.0.0.254	

Figure 26 PC 1 DHCP helper address.

☒ DHCP	☐ Static	DHCP request successful.
IPv4 Address	170.23.0.1	
Subnet Mask	255.255.0.0	
Default Gateway	170.23.0.254	
DNS Server	170.23.0.254	

Test shows error corrected for helper addresses

Figure 27 PC 2 DHCP helper address.

Figures 26 and 27 show the DHCP with helper addresses. These tests show that PC 1 and PC 2 on routers 2 and 3 are now configured dynamically.

IP Configuration		
☒ DHCP	☐ Static	DHCP request successful.
IPv4 Address	192.168.3.11	
Subnet Mask	255.255.255.0	
Default Gateway	192.168.3.254	
DNS Server	192.168.3.254	

Figure 28 PC 0 test for excluded addresses.

IP Configuration

☒ DHCP ☐ Static DHCP request successful.

IPv4 Address	103.0.0.11
Subnet Mask	255.0.0.0
Default Gateway	103.0.0.254
DNS Server	103.0.0.254

Figure 29 Figure 28 PC 1 test for excluded addresses.

IP Configuration

☒ DHCP ☐ Static DHCP request successful.

IPv4 Address	170.23.0.11
Subnet Mask	255.255.0.0
Default Gateway	170.23.0.254
DNS Server	170.23.0.254

Exclusion addresses test is good and shows the first 10 addresses are excluded

Figure 30 Figure 28 PC 2 test for excluded addresses.

Figure 28-30 show the tests for excluded addresses. These tests prove that the excluded addresses from 1 to 10 in each LAN have been successful. This means that the addresses for each specific controller will be kept static and will not be affected by the dynamic DHCP addressing protocol. *Good explanation*

The final test is to prove that the 3 routers can all run the configuration. These screenshots can be found in the appendix.

6. Evaluation

By conducting research into OSI 7-layer, the task of using different routing methods and IP classes could be carried out. Static routing was carried out first where each device must be configured manually from the terminal. RIP routing allowed us to route multiple devices at a quicker speed than manually setting the IP addresses with static routing. Also, it allowed the device to be configured remotely. But the IP address of the router must be known. DHCP also known as Dynamic Host Communication Protocol is much more complex to configure to the router. But once the devices are configured, they don't need to be configured manually as the IP address is now assigned to them automatically. Overall, the practical tasks go together with the research task which are essential for Element 2 where these configurations are explored further.

Good evaluation

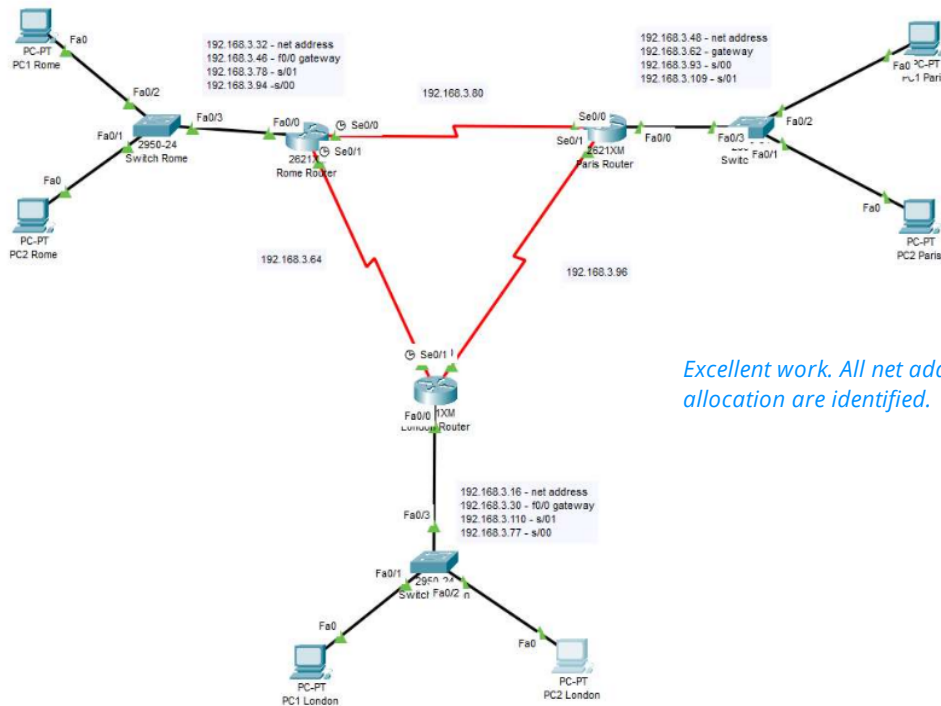
Element 2

1. Introduction

This element will use the knowledge gained from the research and practical tasks of Element 1 to build a new network using CIDR/27, CIDR/30 and VLAN or better known as Virtual Local Area Networks. This will be implemented to allow the networks to work together as one broadcast domain. An access control list will be used to limit the access to one router. Also, CIDR/28 will be used for a better understanding of how CIDR works and how to Implement it to a wider network using RIP routing.

CIDR /28 will be configured first

2. System Configuration Requirements



Excellent work. All net addresses and port allocation are identified.

Figure 31 Network design using CIDR/28 subnetting.

The circuit shown above is the circuit that will be used to implement all the changes. It also shows all the IP addresses.

CIDR/28 Rome Network 1 Lan address 32

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240 /28
	0	0	0	0	0	0	0	0	192.168.3.32
	0	0	0	0	0	0	0	0	Not used
Net addr 32	0	0	1	0	0	0	0	1	Lowest host addr 33
Net addr 32	0	0	1	0	0	0	1	0	Next host addr 34
Default gateway	0	0	1	0	1	1	1	0	Fastethernet 0/0 addr 46
Broadcast	0	0	1	0	1	1	1	1	Broadcast 47

Figure 32 CIDR/28 Rome**CIDR/28 Paris Network 2 Lan address 48**

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240 /28
	0	0	0	0	0	0	0	0	192.168.3.48
	0	0	0	0	0	0	0	0	Not used
Net addr 48	0	0	1	1	0	0	0	1	Lowest host addr 49
Net addr 48	0	0	1	1	0	0	1	0	Next host addr 50
Default gateway	0	0	1	1	1	1	1	0	Fastethernet 0/0 addr 62
Broadcast	0	0	1	1	1	1	1	1	Broadcast 63

Figure 33 CIDR/28 Paris**CIDR/28 London Network 3 Lan address 16**

Subnet mask	1	1	1	1	0	0	0	0	255.255.255.240 /28
	0	0	0	0	0	0	0	0	192.168.3.16
	0	0	0	0	0	0	0	0	Not used
Net addr 16	0	0	0	1	0	0	0	1	Lowest host addr 17
Net addr 16	0	0	0	1	0	0	1	0	Next host addr 18
Default gateway	0	0	0	1	1	1	1	0	Fastethernet 0/0 addr 30
Broadcast	0	0	0	1	1	1	1	1	Broadcast 31

Figure 34 CIDR/28 London

LAN net addresses are established with device address allocation

Rome – Paris Network 4 Network address 80

Paris Router	0	1	0	1	1	1	0	1	Serial 0/0 addr 93
Rome Router	0	1	0	1	1	1	1	0	Serial 0/0 addr 94

Figure 35 CIDR/28 Paris-Rome

Paris –London Network 5 Network address 96

Paris Router	0	1	1	0	1	1	0	1	Serial 0/1 addr 109
London Router	0	1	1	0	1	1	1	0	Serial 0/1 addr 110

Figure 36 CIDR/28 Paris-London

London – Rome Network 6 Network address 64

London Router	0	1	0	0	1	1	0	1	Serial 0/0 addr 77
Rome Router	0	1	0	0	1	1	1	0	Serial 0/1 addr 78

Good work. Serial address allocation is established

Figure 37 CIDR/28 London-Rome

These tables above provide the addresses required to use CIDR/28 subnetting.

For CIDR/27 and CIDR/30, different tables were required.

CIDR/27 Networks 1,2 and 3

Subnet mask	1	1	1	0	0	0	0	0	255.255.255.224
	0	0	0	0	0	0	0	0	Not used
Net addr 32	0	0	1	0	0	0	0	1	Lowest host addr 33 Rome 1
Net addr 32	0	0	1	0	0	0	1	0	Next host addr 34 Rome 2
Net addr 32	0	0	1	1	1	1	1	0	Highest Router addr 62 Rome Router
Net addr 64	0	1	0	0	0	0	0	1	Lowest host addr 65 London 1
Net addr 64	0	1	0	0	0	0	1	0	Next host addr 66 London 2
Net addr 64	0	1	0	1	1	1	1	0	Highest Router addr 94 London Router
Net addr 96	0	1	1	0	0	0	0	1	Lowest host addr 97 Paris 1
Net addr 96	0	1	1	0	0	0	1	0	Next host addr 98 Paris 2
Net addr 96	0	1	1	1	1	1	1	0	Highest Router addr 126 Paris Router

Good work here

Figure 38 CIDR/27 Network table.

CIDR/30 Networks 4,5 and 6

Subnet mask	1	1	1	1	1	1	0	0	255.255.255.252
	0	0	0	0	0	0	0	0	Not used
Net addr 4	0	0	0	0	0	1	0	1	Lowest interface addr 5 Rome serial 0/0
Net addr 4	0	0	0	0	0	1	1	0	Highest interface addr 6 Paris serial 0/0
Net addr 8	0	0	0	0	1	0	0	1	Lowest interface addr 9 Rome serial 0/1
Net addr 8	0	0	0	0	1	0	1	0	Highest interface addr 10 London serial 0/0
Net addr 12	0	0	0	0	1	1	0	1	Lowest interface addr 13 London serial 0/1
Net addr 12	0	0	0	0	1	1	1	0	Highest interface addr 14 Paris serial 0/1

Good work. Serial link port addresses are established

Figure 39 CIDR/30 Network table.

Figures 38 and 39 provide the addresses required to implement the subnetting. Compared to CIDR/28 the CIDR/30 and CIDR/27 will be implemented at the same time. The router automatically knows which type of CIDR is being used from the subnets. *Good point here*

Another table is required for the VLAN addresses. And the VLAN will be implemented onto the London network.

VLANs London Router/Switch for CIDR/27 sub network

FastEthernet 0/0.1	0	1	0	1	1	1	1	0	Net addr 64 i/f addr 94
FastEthernet 0/0.2	1	0	0	1	1	1	1	0	Net addr 128 i/f addr 158
PC1 London	0	1	0	0	0	0	0	1	Net addr 64 host addr 65
PC2 London	1	0	0	0	0	0	0	1	Net addr 128 host addr 129

Good work. The extra address is identified

Figure 40 CIDR/27 VLAN London

London Router – FastEthernet 0/0.1 ip address 192.168.30.94 255.255.255.224.

London Router – FastEthernet 0/0.2 ip address 192.168.30.158 255.255.255.224.

London Switch – FastEthernet 0/24 – linked to London Router with encapsulation vlan 2 and vlan 3.

London Switch – FastEthernet 0/2 – set as vlan 2 linked to PC1 London

London Switch – FastEthernet 0/3 – set as vlan 3 linked to PC2 London

Good work. Inter-Vlan routing is identified

There should be some evidence here of the Vlan config

3. Implementation

CIDR/28 is implemented using RIP version 2 using the CLI in the routers.

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 192.168.3.32
Router(config-router)#net 192.168.3.4
Router(config-router)#net 192.168.3.8
Router(config-router)#exit
Router(config)#
```

Figure 41 Rome CIDR/28 CLI

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#192.168.3.96
      ^
% Invalid input detected at '^' marker.

Router(config-router)#net 192.168.3.96
Router(config-router)#net 192.168.3.4
Router(config-router)#net 192.168.3.12
Router(config-router)#exit
Router(config)#
```

Figure 42 Paris CIDR/28 CLI

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 192,168.3.64
      ^
% Invalid input detected at '^' marker.

Router(config-router)#net 192.168.3.64
Router(config-router)#net 192.168.3.8
Router(config-router)#net 192.168.3.12
Router(config-router)#exit
Router(config)#
```

Good evidence of the RIP config

Figure 43 London CIDR/28 CLI

To make sure all the routers accepted CIDR/28 routing table were checked as seen below.

Routing Table for London Router

Type	Network	Port	Next Hop IP	Metric
C	192.168.3.16/28	FastEthernet0/0	---	0/0
R	192.168.3.32/28	Serial0/0	192.168.3.78	120/1
R	192.168.3.48/28	Serial0/1	192.168.3.109	120/1
C	192.168.3.64/28	Serial0/0	---	0/0
R	192.168.3.80/28	Serial0/0	192.168.3.78	120/1
R	192.168.3.80/28	Serial0/1	192.168.3.109	120/1
C	192.168.3.96/28	Serial0/1	---	0/0

Figure 44 London Routing Table CIDR/28

Routing Table for Rome Router

Type	Network	Port	Next Hop IP	Metric
R	192.168.3.16/28	Serial0/1	192.168.3.77	120/1
C	192.168.3.32/28	FastEthernet0/0	---	0/0
R	192.168.3.48/28	Serial0/0	192.168.3.93	120/1
C	192.168.3.64/28	Serial0/1	---	0/0
C	192.168.3.80/28	Serial0/0	---	0/0
R	192.168.3.96/28	Serial0/1	192.168.3.77	120/1
R	192.168.3.96/28	Serial0/0	192.168.3.93	120/1

Figure 45 Rome Routing Table CIDR/28

Routing Table for Paris Router

Type	Network	Port	Next Hop IP	Metric
R	192.168.3.16/28	Serial0/1	192.168.3.110	120/1
R	192.168.3.32/28	Serial0/0	192.168.3.94	120/1
C	192.168.3.48/28	FastEthernet0/0	---	0/0
R	192.168.3.64/28	Serial0/0	192.168.3.94	120/1
R	192.168.3.64/28	Serial0/1	192.168.3.110	120/1
C	192.168.3.80/28	Serial0/0	---	0/0
C	192.168.3.96/28	Serial0/1	---	0/0

Routing tables are correct and show all addresses and routing paths

Figure 46 Paris Routing Table CIDR/28

Figures 44-46 show that each router has been configured using CIDR/28. Looking at the network addresses it is followed by a /28. This is evidence that the router identifies the CIDR by the subnet. To make sure that the addresses configured work as intended. Packets were sent between the PC's. *Good point*

CIDR/27 and CIDR/30

```
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 192.168.3.32
Router(config-router)#net 192.168.3.4
Router(config-router)#net 192.168.3.8
Router(config-router)#exit
Router(config)#
```

Figure 41 Rome CIDR/27 and CIDR/30 CLI

```
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#192.168.3.96
      ^
% Invalid input detected at '^' marker.

Router(config-router)#net 192.168.3.96
Router(config-router)#net 192.168.3.4
Router(config-router)#net 192.168.3.12
Router(config-router)#exit
Router(config)#
```

Figure 42 Paris CIDR/27 and CIDR/30 CLI

```

Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#net 192.168.3.64
      ^
% Invalid input detected at '^' marker.

Router(config-router)#net 192.168.3.64
Router(config-router)#net 192.168.3.8
Router(config-router)#net 192.168.3.12
Router(config-router)#exit
Router(config)#

```

RIP is configured for /27 and /30 VLSM and the changes of addresses are indicated

Figure 43 London CIDR/27 and CIDR/30 CLI

CIDR/27 and CIDR/30 are known as the variable length subnet mask. These are also implemented through the CLI commands.

Routing Table for London Router

Type	Network	Port	Next Hop IP	Metric
R	192.168.3.4/30	Serial0/0	192.168.3.9	120/1
C	192.168.3.8/30	Serial0/0	---	0/0
C	192.168.3.12/30	Serial0/1	---	0/0
R	192.168.3.32/27	Serial0/0	192.168.3.9	120/1
C	192.168.3.64/27	FastEthernet0/0	---	0/0
R	192.168.3.96/27	Serial0/1	192.168.3.14	120/1

Figure 44 London Routing Table CIDR/27 & CIDR/30

Routing Table for Rome Router

Type	Network	Port	Next Hop IP	Metric
C	192.168.3.4/30	Serial0/0	---	0/0
C	192.168.3.8/30	Serial0/1	---	0/0
R	192.168.3.12/30	Serial0/0	192.168.3.6	120/1
R	192.168.3.12/30	Serial0/1	192.168.3.10	120/1
C	192.168.3.32/27	FastEthernet0/0	---	0/0
R	192.168.3.64/27	Serial0/1	192.168.3.10	120/1

Figure 45 Rome Routing Table CIDR/27 & CIDR/30

Routing Table for Paris Router

Type	Network	Port	Next Hop IP	Metric
C	192.168.3.4/30	Serial0/0	---	0/0
R	192.168.3.8/30	Serial0/0	192.168.3.5	120/1
R	192.168.3.8/30	Serial0/1	192.168.3.13	120/1
C	192.168.3.12/30	Serial0/1	---	0/0
R	192.168.3.32/27	Serial0/0	192.168.3.5	120/1
R	192.168.3.64/27	Serial0/1	192.168.3.13	120/1

RIP tables are correct

Figure 46 Paris Routing Table CIDR/27 & CIDR/30

4. Testing and Analysis

PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	I
	Successful	PC1 Rome	PC1 Paris	ICMP		0.000	
	Successful	PC1 Paris	PC1 Rome	ICMP		0.000	
	Failed	PC2 Rome	PC1 London	ICMP		0.000	
	Successful	PC2 Rome	PC1 London	ICMP		0.000	
	Successful	PC1 Lon...	PC2 Rome	ICMP		0.000	
	Successful	PC2 Lon...	PC2 Paris	ICMP		0.000	
	Successful	PC2 Paris	PC2 London	ICMP		0.000	

Good set of test results

Figure 47 CIDR/28 Testing

A test was conducted on CIDR/28 when all the construction was completed. A combination of packet tests and pings were used to test the protocols. All the PCs on the network were used for the testing. This was done by pinging for example Rome to Paris etc. *Good explanation*

PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	PC1 Rome	PC1 Paris	ICMP		0.000	N	0	(edit)
	Successful	PC1 Paris	PC1 Rome	ICMP		0.000	N	1	(edit)
	Successful	PC2 Rome	PC1 London	ICMP		0.000	N	2	(edit)
	Successful	PC1 Lon...	PC2 Rome	ICMP		0.000	N	3	(edit)
	Successful	PC2 Paris	PC2 London	ICMP		0.000	N	4	(edit)
	Successful	PC2 Lon...	PC2 Paris	ICMP		0.000	N	5	(edit)

Figure 48 CIDR/27 & CIDR/30 Testing

Good set of test results

A Test was conducted on CIDR/27 & CIDR/30 this was the same test done on CIDR/28. The tests carried out were successful.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Failed	PC2 Lon...	PC1 London	ICMP		0.000	N	0	(edit)	
	Successful	PC2 Lon...	PC1 London	ICMP		0.000	N	1	(edit)	
	Successful	PC1 Lon...	PC2 London	ICMP		0.000	N	2	(edit)	

Figure 49 VLAN Testing

The VLAN testing required the same network to ping the different PCs in the network.

```
C:\>ping 192.168.3.97

Pinging 192.168.3.97 with 32 bytes of data:

Reply from 192.168.3.97: bytes=32 time=10ms TTL=126
Reply from 192.168.3.97: bytes=32 time=2ms TTL=126
Reply from 192.168.3.97: bytes=32 time=1ms TTL=126
Reply from 192.168.3.97: bytes=32 time=8ms TTL=126

Ping statistics for 192.168.3.97:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 10ms, Average = 5ms
```

Figure 50 Ping Testing 1

```
C:\>ping 192.168.3.129

Pinging 192.168.3.129 with 32 bytes of data:

Reply from 192.168.3.129: bytes=32 time=1ms TTL=126
Reply from 192.168.3.129: bytes=32 time=10ms TTL=126
Reply from 192.168.3.129: bytes=32 time=1ms TTL=126
Reply from 192.168.3.129: bytes=32 time=5ms TTL=126

Ping statistics for 192.168.3.129:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 10ms, Average = 4ms
```

Vlan tests prove the comms over the Vlan's which are actual different networks

Figure 51 Ping Testing 2

The ping testing in figures 50 and 51 show that they were successful proving that the network restricting was successful and that the access was only restricted to the desired device.

5. Evaluation

The aim of this Element was to apply classless inter-domain routing and a virtual local area network to a circuit. To find out if they were configured correctly. Tables were used to show all the different addresses that were required. This included the host and broadcast addresses. The CIDR routes were all applied using the RIP routing version 2. This method detects the gateway being used and used to determine the CIDR in place.

The applied routes could be found by accessing the routing tables for the routers. The tests involved with this included transferring packets between devices on different local area networks.

CIDR/27 and CIDR/30 were modified to use VLAN to reduce the traffic on the broadcast domain.

All the testing for the methods proved successful. This provides evidence that all the modifications were implemented correctly.

Good evaluation

Element 3

1. Introduction

The purpose of this element is to improve the network performance of the network using logical grouping of end devices using a VLAN implemented on the London switch. Also, a test will be done on the network using hypertext transfer protocol (HTTP) by using open-source software than can access PLC data across the network. *Good intro*

2. System configuration requirements

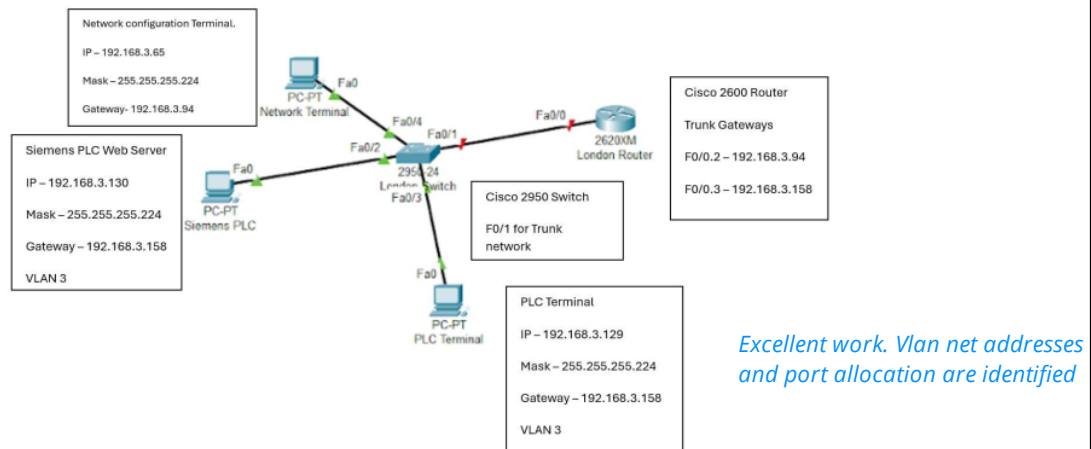


Figure 52 Diagram of real-life built system.



Good image of prac setup

Figure 53 Physical setup of the system.

Figure 53 shows the physical setup of the system which included:

Laptop PC's x 2

Siemens PLC

Cisco 2600 router

Cisco 2950 switch

One of the laptops is for configuring the switch and the router. The other laptop is used to program the PLC and then read real-time data from the PLC.

3. Implementation

A new PLC Project was created to configure the PLC a web server had to be activated with the PLC as seen in figure 54.

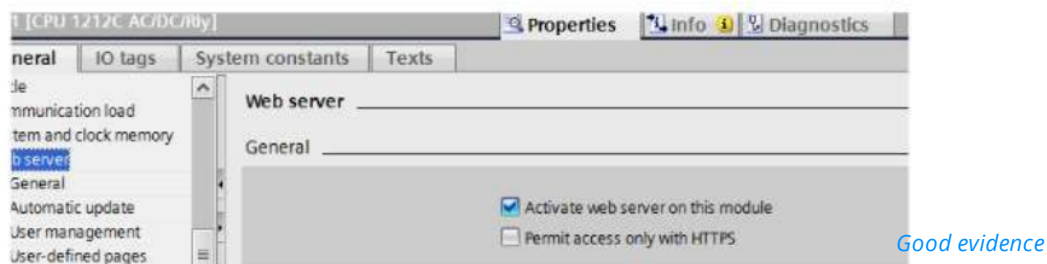


Figure 54 Activation of the webserver on the PLC.

After this was done a file extension could be added to the web program as seen in figure 55.

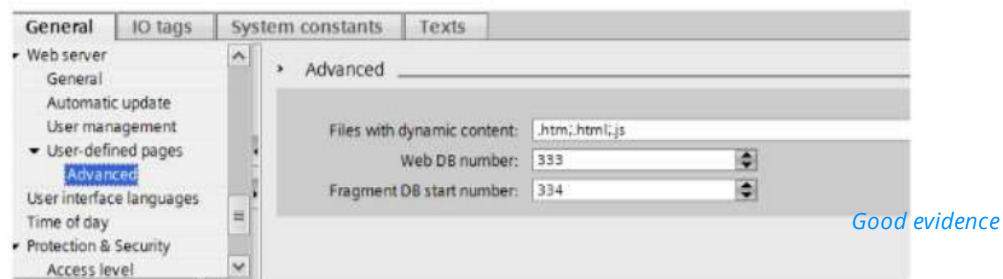


Figure 55 File extension to the PLC.

WEB contrl vlan ▸ PLC_1 [CPU 1212C AC/DC/Rly] ▸ PLC tags ▸ Default tag table [38]

Tags User constants

Default tag table

	Name	Data type	Address	Retain	Acces...	Writa...	Visibl...
1	op	Bool	%Q0.0	☐	☒	☒	☒
2	op2	Bool	%Q0.1	☐	☒	☒	☒
3	op3	Bool	%Q0.2	☐	☒	☒	☒
4	ip	Bool	%I0.0	☐	☒	☒	☒
5	ip1	Bool	%I0.1	☐	☒	☒	☒
6	ip2	Bool	%I0.2	☐	☒	☒	☒
7	ip3	Bool	%I0.3	☐	☒	☒	☒
8	ip4	Bool	%I0.4	☐	☒	☒	☒
9	ip5	Bool	%I0.5	☐	☒	☒	☒
10	ip6	Bool	%I0.6	☐	☒	☒	☒
11	ip7	Bool	%I0.7	☐	☒	☒	☒
12	<Add new>			☐	☒	☒	☒

Figure 56 Input and output configuration.

Figure 56 shows the input and output configuration for the PLC lights these lights will change depending on the output.

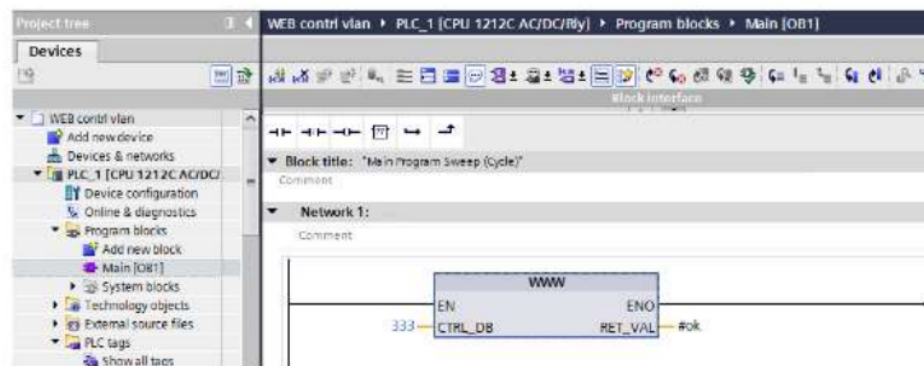


Figure 57 WWW block in the main block of the PLC.

Good evidence. This is the main block for web server access

Figure 57 shows the web server block being added to the main block of the PLC. The web server is now configured and ready for the web pages to be downloaded.

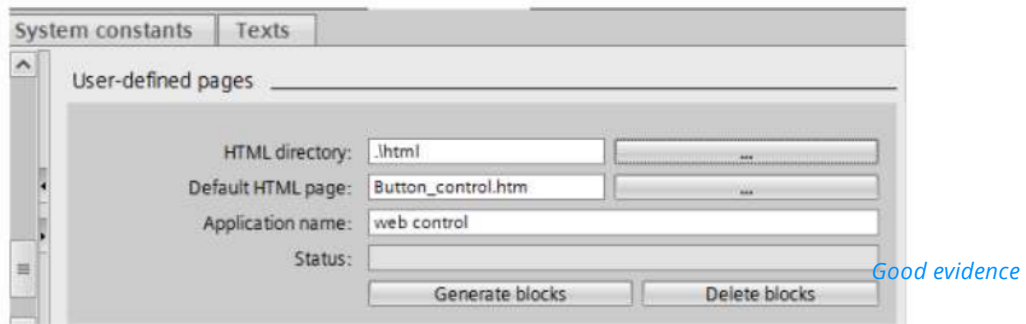


Figure 58 html index and downloading it to the PLC.

Figure 58 shows the html page with the source for the index page being downloaded.

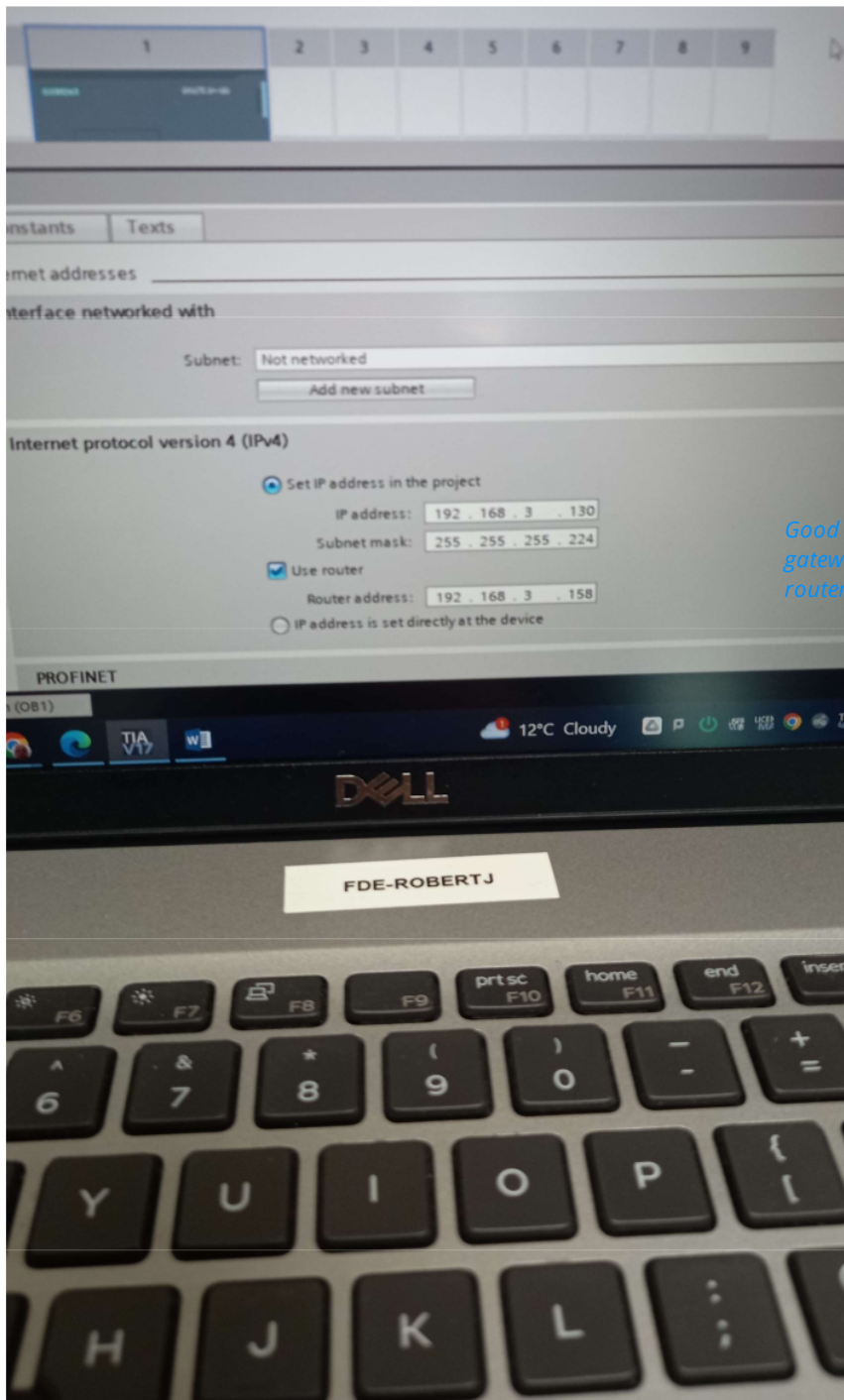


Figure 59 setting up of IP addresses on PLC.

Figure 59 shows the VLAN gateway and IP addresses being set up.

The web page program is stored in the PLC's program folder. It also contains all the files for the web page.

The following code was inputted into the other laptop to set up all the IP's

```
Switch>enable
Switch#conf t
Switch(config)#vlan 2
Switch(config-vlan)#name vlan2
Switch(config-vlan)#exit
Switch(config)#vlan 3
Switch(config-vlan)#name vlan3
Switch(config-vlan)#exit
Switch(config)#^Z
Switch#show vlan
Switch#conf t
Switch(config)#int f0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 3
Switch(config-if)#exit

Switch(config)#int f0/3
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 3
Switch(config-if)#exit

Switch(config)#int f0/4
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 2
Switch(config-if)#exit
Switch(config)#^Z
```

Switch#

Switch#show vlan

Inter VLAN routing

Switch config:

Switch#conf t

Switch(config)#int f0/1

Switch(config-if)#switchport mode trunk

Switch(config-if)#^Z

Switch#

Switch#show interface trunk

Router config:

Router>enable

Router#conf t

Router(config)#int f0/0

Router(config-if)#no shutdown

Router(config-if)#exit

Router(config)#int f0/0

Router(config-if)#no ip address

Router(config-if)#exit

Router(config)#int f0/0.2

Router(config-subif)#encapsulation dot1Q 2

Router(config-subif)#ip address 192.168.3.94 255.255.255.224

Router(config-subif)#no shutdown

Router(config-subif)#exit

Router(config)#int f0/0.3

Router(config-subif)#encapsulation dot1Q 3

Router(config-subif)#ip address 192.168.3.158 255.255.255.224

```
Router(config-subif)#no shutdown
```

```
Router(config-subif)#exit
```

```
Router(config)#^Z
```

```
Router#show ip interfaces brie
```

Good evidence for configuration of Vlans

```
Router#show run
```

4. Testing and analysis

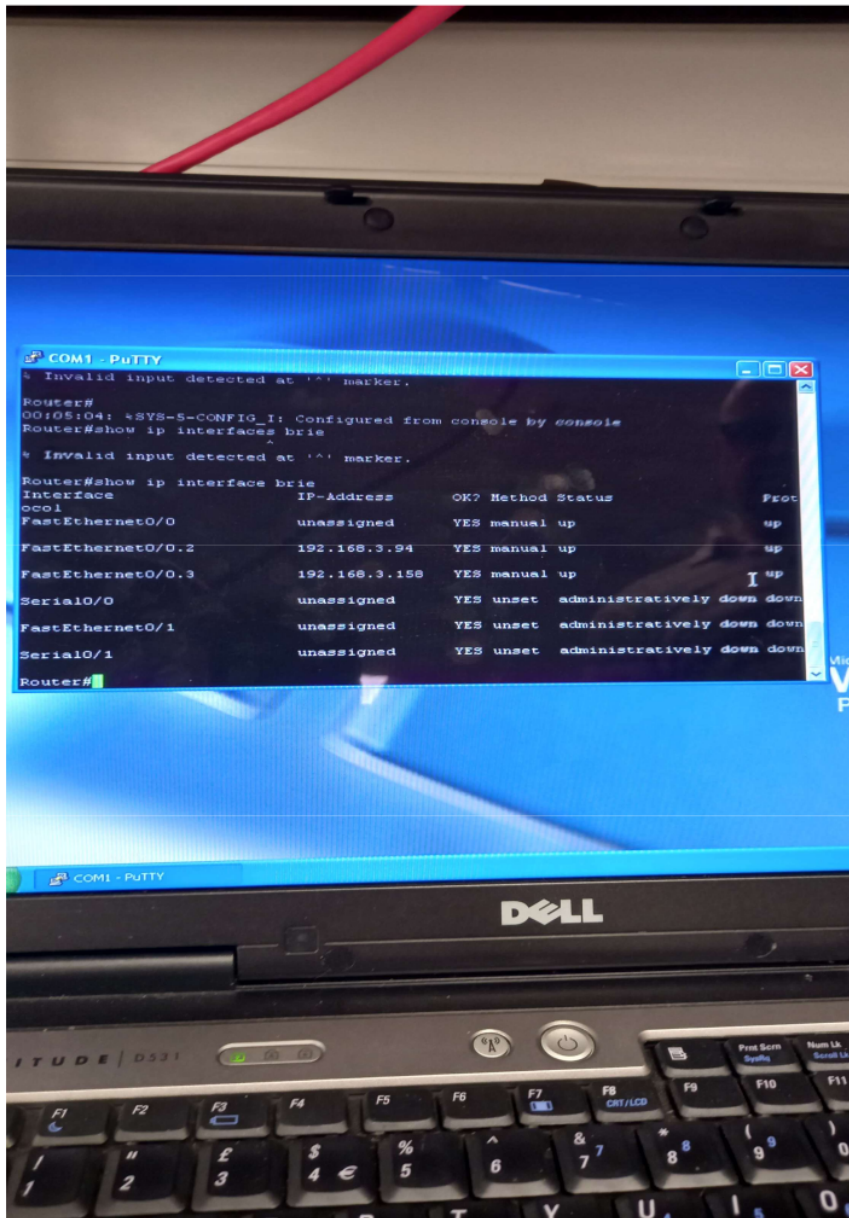
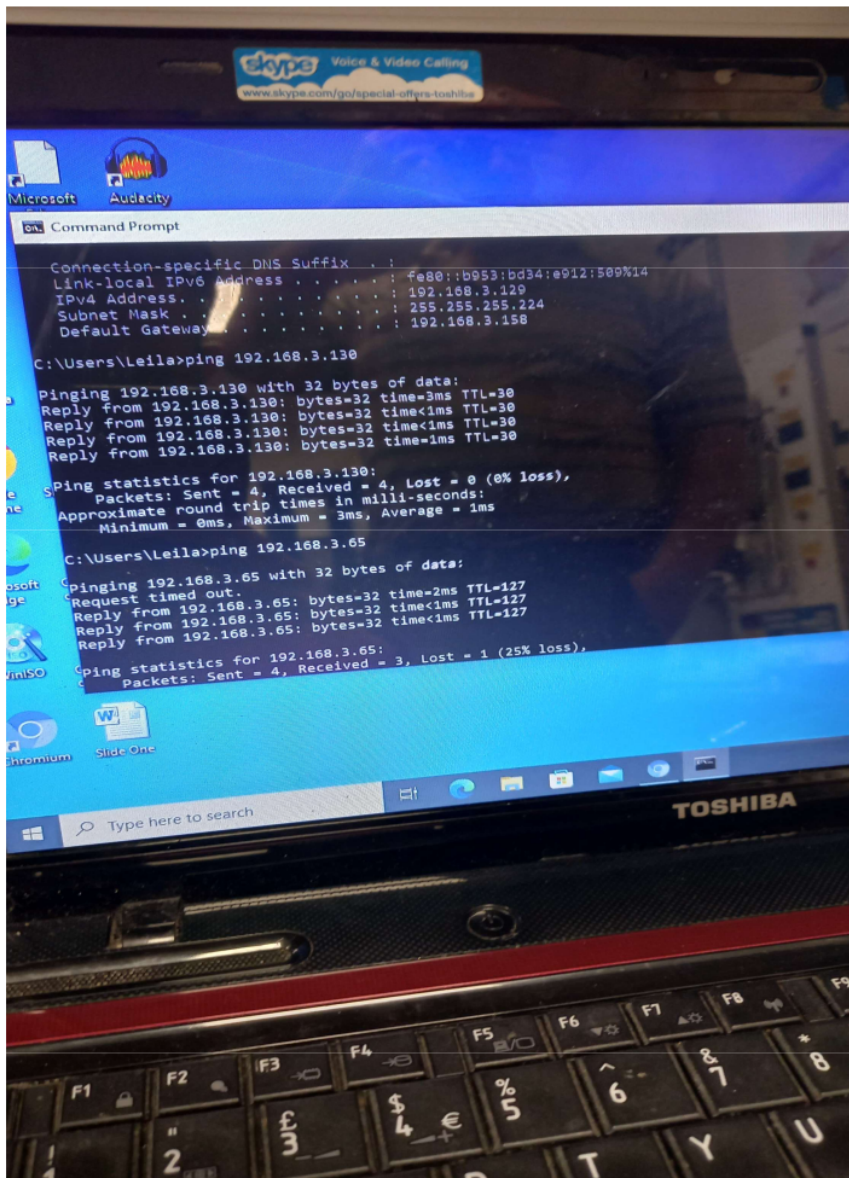


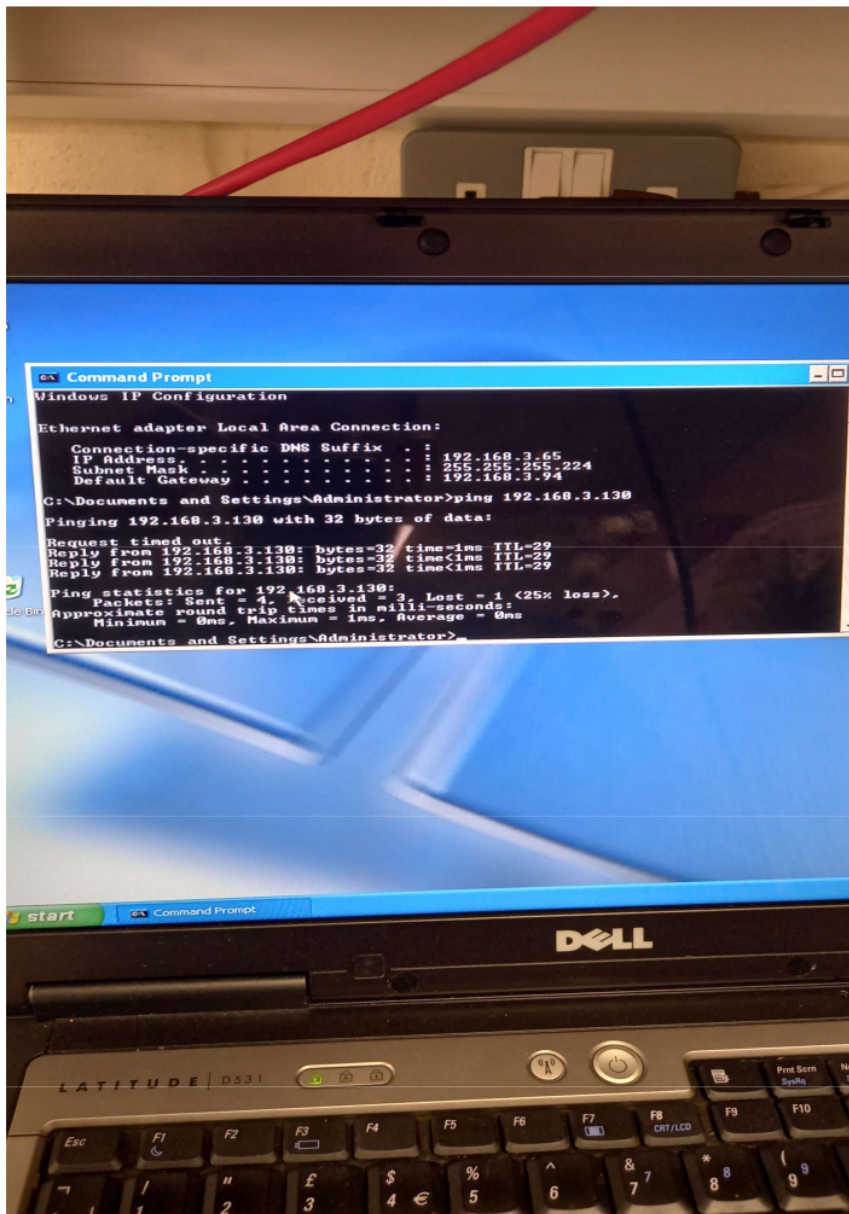
Image shows the Vlans configured with Inter-Vlan routing

Figure 60 VLAN Configuration Tests



Good test showing testing form host

Figure 61 VLAN Configuration Tests



*Good test showing test
from host*

Figure 62 VLAN Configuration Tests

Figures 60-62 show the VLAN Configuration tests.

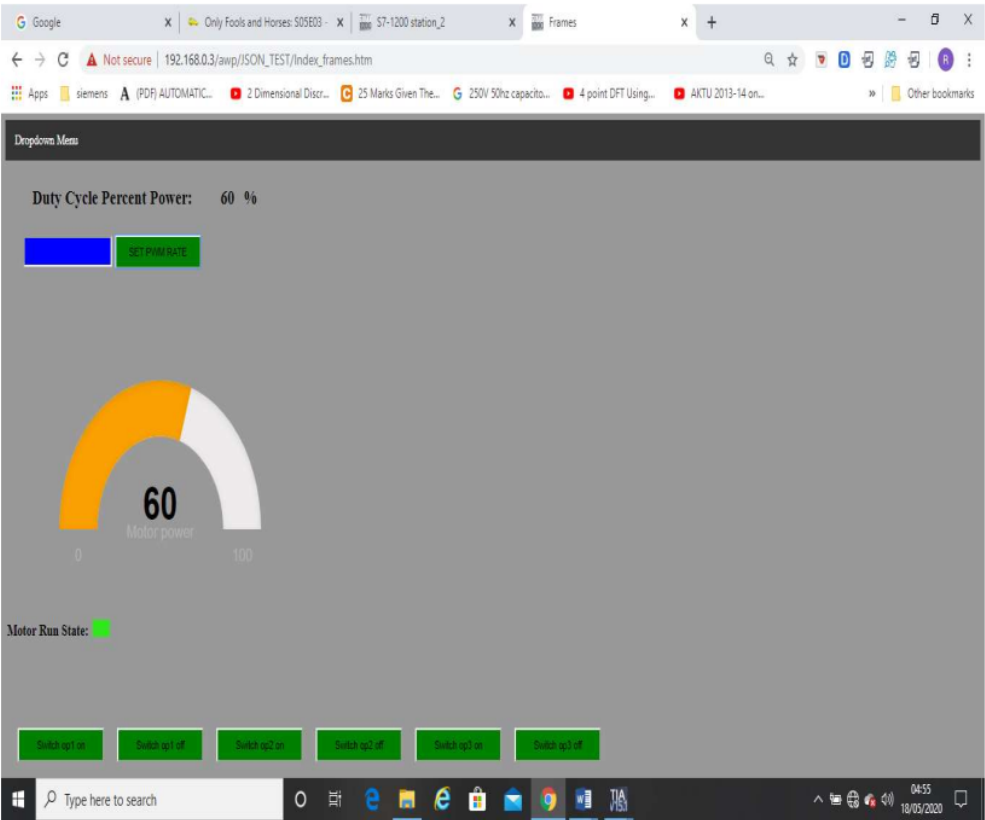


Figure 63 DC motor control Web page running at 60%.

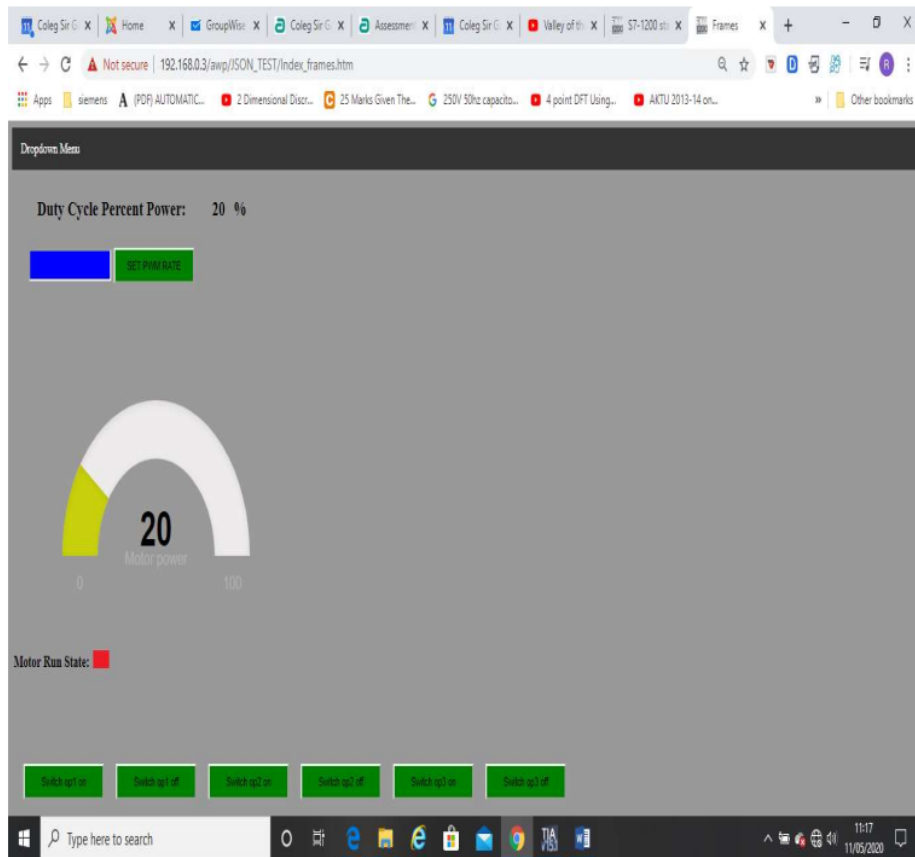


Figure 64 DC motor control Web page running at 60%.

Motor test over Vlan with display on browser page

There should be a monitor and motor image part to go with this

5. Conclusions and recommendations

Element 3 has proven that a simple HTML program and two .png files can show the conditions of a PLC. Theoretically the PC and motor could be in different places in the world. This development of industry 4.0 gives the ability for all devices to talk to each other providing feedback from the production which gives more possibilities of self-diagnostics. Using ethernet allows for much more to be implemented using the java script and much more complex web pages can be built and used with capabilities of a HMI screen.

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[Accessed 13 April 2024].

There should be more sources used

Appendix

Router 1 running config:

Router>en

Router#show run

Building configuration...

Current configuration : 1397 bytes

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

hostname Router

ip dhcp excluded-address 103.0.0.1 103.0.0.10

ip dhcp excluded-address 192.168.3.1 192.168.3.10

ip dhcp excluded-address 170.23.0.1 170.23.0.10

ip dhcp pool net1

network 192.168.3.0 255.255.255.0

default-router 192.168.3.254

dns-server 192.168.3.254

ip dhcp pool net2

network 103.0.0.0 255.0.0.0

default-router 103.0.0.254

dns-server 103.0.0.254

ip dhcp pool net3

network 170.23.0.0 255.255.0.0

default-router 170.23.0.254

dns-server 170.23.0.254

no ip cef

no ipv6 cef

```
interface FastEthernet0/0
ip address 192.168.3.254 255.255.255.0
duplex auto
speed auto
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
```

```
interface Serial0/0
no ip address
clock rate 2000000
shutdown
```

```
interface Serial0/1
no ip address
clock rate 2000000
shutdown
```

```
interface Serial0/2
ip address 10.0.0.1 255.0.0.0
clock rate 2000000
```

```
interface Serial0/3
no ip address
clock rate 2000000
shutdown
```

```
router rip
version 2
network 10.0.0.0
network 103.0.0.0
```

```
network 192.168.3.0
```

```
ip classless
```

```
ip route 103.0.0.0 255.0.0.0 10.0.0.2
```

```
ip route 170.23.0.0 255.255.0.0 10.0.0.2
```

```
ip flow-export version 9
```

```
line con 0
```

```
line aux 0
```

```
line vty 0 4
```

```
login
```

```
end
```

router 2 running config:

```
Router>en
```

```
Router#show run
```

```
Building configuration...
```

```
Current configuration : 993 bytes
```

```
version 12.2
```

```
no service timestamps log datetime msec
```

```
no service timestamps debug datetime msec
```

```
no service password-encryption
```

```
hostname Router
```

```
no ip cef
```

```
no ipv6 cef
```

```
interface FastEthernet0/0
```

```
ip address 103.0.0.254 255.0.0.0
```

```
ip helper-address 10.0.0.1
```

```
duplex auto
```

```
speed auto
```

```
interface FastEthernet0/1
```

```
no ip address
```

```
duplex auto
speed auto
shutdown
```

```
interface Serial0/0
no ip address
clock rate 2000000
shutdown
```

```
interface Serial0/1
no ip address
clock rate 2000000
shutdown
```

```
interface Serial0/2
ip address 10.0.0.2 255.0.0.0
```

```
interface Serial0/3
ip address 11.0.0.1 255.0.0.0
clock rate 2000000
```

```
router rip
version 2
network 10.0.0.0
network 11.0.0.0
network 103.0.0.0
network 170.23.0.0
network 192.168.3.0
```

```
ip classless
ip route 170.23.0.0 255.255.0.0 11.0.0.2
ip route 192.168.3.0 255.255.255.0 10.0.0.1
```

```
ip flow-export version 9
```

```
line con 0
```

```
line aux 0
```

```
line vty 0 4
login
end
```

router 3 running config:

```
Router>en
Router#show run
Building configuration...
```

Current configuration : 864 bytes

```
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
```

```
hostname Router
```

```
no ip cef
no ipv6 cef
```

```
interface FastEthernet0/0
ip address 170.23.0.254 255.255.0.0
ip helper-address 10.0.0.1
duplex auto
speed auto
```

```
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
```

```
interface Serial0/0
no ip address
clock rate 2000000
shutdown
```

```
interface Serial0/1
no ip address
clock rate 2000000
shutdown
```

```
interface Serial0/2
ip address 11.0.0.2 255.0.0.0
```

```
interface Serial0/3
no ip address
clock rate 2000000
shutdown
```

```
router rip
version 2
network 11.0.0.0
network 103.0.0.0
network 170.23.0.0
```

```
ip classless
```

```
ip flow-export version 9
```

```
line con 0
```

```
line aux 0
```

```
line vty 0 4
login
end
```

Good router reports showing all the significant configurations

64/100

PAGE 1

PAGE 2

Text Comment. OSI Models

Text Comment. CIDR /28

Text Comment. Detailed table of contents. Two parts missing.

PAGE 3

PAGE 4

Text Comment. Good extensive list of figures

PAGE 5

Text Comment. Good intro that covers requirements

PAGE 6

Text Comment. Good diagram

Text Comment. There should be a ref here

PAGE 7

Text Comment. Layers are identified

Text Comment. Purpose should be included

Text Comment. There should be a ref here

PAGE 8

Text Comment. Citation should include date after author name

Text Comment. Purpose is identified

Text Comment. 4 layers are identified

PAGE 9

Text Comment. Ref needed here

Text Comment. Ref needed here

Text Comment. Explanations could be more detailed, however, the purpose is identified and with good supporting diagrams

PAGE 10

Text Comment. Incorrect citation

Text Comment. Correct citation

Text Comment. Good point with common example

Text Comment. Good point

PAGE 11

Text Comment. Good topology with net addresses and port allocation

Text Comment. Good points

PAGE 12

Text Comment. The tables should be presented more effectively

Text Comment. Net address scheme is identified for all networks including serial links

Text Comment. switch

Text Comment. Good explanation

Text Comment. Table indicates all net addresses are routed

Text Comment. Correct routing table

Text Comment. Correct routing table

Text Comment. Correct dynamic routing table

Text Comment. Correct table

Text Comment. Correct table

Text Comment. Dynamic routing evidence shows how the tables have been created for each router

Text Comment. There should be a heading here

Text Comment. Good evidence of dynamic addressing implementation

Text Comment. Exclusion addresses evidence

Text Comment. Good set of test results

Text Comment. Good explanation of test

Text Comment. Good set of test results

PAGE 22

Text Comment. There should be a heading here for dynamic addressing test

Text Comment. Good test showing errors without helper addresses

PAGE 23

Text Comment. Test shows error corrected for helper addresses

PAGE 24

Text Comment. Exclusion addresses test is good and shows the first 10 addresses are excluded

Text Comment. Good explanation

PAGE 25

Text Comment. Good evaluation

PAGE 26

Text Comment. CIDR /28 will be configured first

PAGE 27

Text Comment. Excellent work. All net addresses and port allocation are identified.

PAGE 28

Text Comment. LAN net addresses are established with device address allocation

PAGE 29

Text Comment. Good work. Serial address allocation is established

PAGE 30

Text Comment. Good work here

Text Comment. Good work. Serial link port addresses are established

Text Comment. Good point here

PAGE 31

Text Comment. Good work. The extra address is identified

Text Comment. Good work. Inter-Vlan routing is identified

Text Comment. There should be some evidence here of the Vlan config

PAGE 32

Text Comment. Good evidence of the RIP config

PAGE 33

Text Comment. Routing tables are correct and show all addresses and routing paths

PAGE 34

Text Comment. Good point

PAGE 35

Text Comment. RIP is configured for /27 and /30 VLSM and the changes of addresses are indicated

PAGE 36

Text Comment. RIP tables are correct

PAGE 37

Text Comment. Good set of test results

Text Comment. Good explanation

Text Comment. Good set of test results

PAGE 38

Text Comment. Vlan tests prove the comms over the Vlans which are actual different networks

PAGE 39

PAGE 40

Text Comment. Good evaluation

PAGE 41

Text Comment. Good intro

PAGE 42

Text Comment. Excellent work. Vlan net addresses and port allocation are identified

PAGE 43

Text Comment. Good image of prac setup

PAGE 44

Text Comment. Good evidence

Text Comment. Good evidence

PAGE 45

Text Comment. Good evidence. This is the main block for web server access

PAGE 46

Text Comment. Good evidence

PAGE 47

Text Comment. Good evidence showing the gateway address configured for router on PLC.

PAGE 48

PAGE 49

PAGE 50

Text Comment. Good evidence for configuration of Vlans

PAGE 51

Text Comment. Image shows the Vlans configured with Inter-Vlan routing

PAGE 52

Text Comment. Good test showing testing from host

PAGE 53

Text Comment. Good test showing test from host

PAGE 54

PAGE 55

Text Comment. Motor test over Vlan with display on browser page

Text Comment. There should be a monitor and motor image part to go with this

PAGE 56

PAGE 57

Text Comment. There should be more sources used

PAGE 58

PAGE 59

PAGE 60

PAGE 61

PAGE 62

PAGE 63

Text Comment. Good router reports showing all the significant configurations

RESEARCH-INFORMED LITERATURE



Research includes good points, but fall short in some areas.
Most of the citations are incorrect and there are parts with refs missing.

4/10

KNOWLEDGE AND UNDERSTANDING



E1. Helper addresses config is tested but implementaion not explained.
All other parts are very well presented.
Good evaluation. 7/10
E2. No evidence of Vlan configuration
Good evaluation
Some headings missing to identfiy content.
Good evidence of implementation with good structure. 6.5/10
E3. Good implementation structure with good methods used.
Evedence is presented effectively and clearly shows the prac setup.
Some parts for the PLC test are missing which show the real time evidence for the browser HMI.
Generally a good understanding demonstrated.
6.5/10

20/30

ANALYSIS



E1. Good test results and DHCP error correction is tested. The helper address config is missing but should have been explained. 3/5

E2. The test results prove the operation of the network for all CIDR arrangements. The VLAN is developed from the final CIDR design and tests prove the configuration. 7/10

E3. Motor test should have a monitor and motor images to go with the browser page images. Good test carried out for Vlans with host identification. 6/10

16/25

PRACTICAL APPLICATION AND DEP.



E1 - Implementation from topology design carried out using address schematic table method. Testing procedure tested every device in every direction and proved successful. DHCP tested but helper address should be explained if evidence is missing. 3.5/5

E2 - Implementations for CIDR are successful. Network was further developed for VLAN configuration. some evidence is missing. 3.5/5

E3 - The practical network has been successfully implemented and tested. The PLC router config evidence is included. The function calls have not been explained. 7/10

14/20

SKILLS FOR PROFESSIONAL PRAC.



Report has good structure but there soem heading mising to identify content. 10/15

10/15